Claims

1. (Currently amended) A cold hearth melting and refining arrangement comprising:

a cold hearth configured to hold a pool of molten material;

a first electron gun of a first type, wherein the first electron gun's geometric position relative to the cold hearth and the first electron gun's power specifications namely voltage, current and pulse rate specifications are selected so that an electron beam generated by the first electron gun can deliver sufficient power to the surface of the pool of molten material to keep the material therein in its molten state;

~~a skull wing inhibiting configuration comprising means comprising a second electron gun and a programmable device coupled to the electron gun, wherein the second electron gun's geometric position relative to the cold hearth and the second electron gun's power specifications namely voltage, current and pulse rate specifications are selected so that the skull wing inhibiting configuration can provides an electron beam that sweeps along at least a portion of the perimeter of the pool of molten material~~ means to inhibit formation of skull wings at the edges of the pool of molten metal formed by the electron beam generated by the first electron gun.

2. (Currently amended). The cold hearth melting and refining arrangement of claim 1, wherein the means comprises a ~~the~~ programmable device coupled to a second electron gun of a second type that is disposed at geometric position relative to the cold hearth and having power specifications namely voltage, current and pulse rate specifications different than those for the first electron gun of the first type, the programmable device having a first ~~comprises a program~~ set of program instructions executable so that ~~which can be executed so~~ the second electron gun ~~skull wing inhibiting~~

~~configuration~~ provides an electron beam that continuously sweeps along at least a portion of the perimeter of the pool of the pool of molten material to inhibit formation of skull wings at the edges of the pool of molten metal.

3. (Currently amended). The cold hearth melting and refining arrangement of claim 2, wherein the programmable device comprises a second set of program instructions executable ~~which can be executed~~ so that the second electron gun ~~skull wing inhibiting configuration~~ provides an electron beam that circumscribes the portion of the perimeter of the pool of molten material with a time period that is in the range of about one millisecond to about several seconds.

4. (Currently amended). The cold hearth melting and refining arrangement of claim 1, wherein the programmable device comprises a third set of program instructions executable ~~which can be executed~~ so that the second electron gun ~~skull wing inhibiting configuration~~ provides an electron beam that sweeps along at least a portion of the perimeter of the pool of molten material in a step-and-scan mode.

5. (Currently amended). The cold heart melting and refining arrangement of claim 4 wherein the programmable device comprises a fourth set of program instructions executable ~~which can be executed~~ so that the second electron gun ~~skull wing inhibiting configuration~~ provides an electron beam that has a dwell time at a spot between steps is in the range of about one millisecond to about hundreds of milliseconds.

6. (Currently amended). The cold hearth melting and refining arrangement of claim 1 wherein the programmable device comprises a fifth set of program instructions executable ~~which can be executed~~ so that the second electron gun ~~skull wing inhibiting~~

~~configuration~~ provides an electron beam that delivers energy to clear the portion of the perimeter of the pool of molten material of volatile impurities that evaporate from the pool of molten material and recondense on the perimeter.

7. (Currently amended). A method of cleaning a perimeter of a pool of molten material formed by a first electron beam generated by an electron gun of a first type in a cold hearth melting and refining arrangement, comprising

utilizing an electron gun of a second type to generate ~~an~~ a second electron beam; and

using a programmable device to automatically sweep a portion of the perimeter of the liquid pool with the second electron beam so that volatile impurities that evaporate from the pool of molten material formed by the first electron beam generated by the electron gun of the first type and recondense on the perimeter of the pool of molten material are dispersed.

8. (Currently amended) The method of claim 7 wherein sweeping a portion of the perimeter of the liquid pool with the second electron beam comprises continuously sweeping the second electron beam along at least a portion of the perimeter of the liquid pool.

9. (Currently amended) The method of claim 7 wherein sweeping a portion of the perimeter of the liquid pool with the second electron beam comprises circumscribing the portion of the perimeter of the pool of molten material with the second electron beam in a time period that is in the range of about one millisecond to about several seconds.

10. (Currently amended) The method of claim 7 wherein sweeping a portion of the perimeter of the liquid pool with the second electron beam comprises sweeping the second electron beam in a step-and-scan mode.

11. (Currently amended) The method of claim 10 wherein sweeping the second electron beam in a step-and-scan mode comprises using ~~an~~ the second electron beam with a dwell time in the range of about one millisecond to about hundreds of milliseconds at a spot between steps.

12. (Currently amended) The method of claim 7 wherein sweeping a portion of the perimeter of the liquid pool with the second electron beam comprises using ~~an~~ the second electron beam to deliver energy to clear the portion of the perimeter of the pool of molten material of volatile impurities that evaporate from the pool of molten material and recondense on the perimeter.